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Attachment and Motivational Systems: Relevance of Sensitivity to Punishment for Eating Disorder Psychopathology

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Abstract

An altered balance of reward and inhibition systems may explain Eating Disorder (ED) behaviors and could be related to difficulties in socio-emotional processing. According to attachment theory, early interaction with caregivers affects the ability to regulate emotion in adult interpersonal situation. The aim of our study was to investigate if insecure attachment may be related to ED symptomatology through changes in reward and inhibition systems.

Seventy-eight people affected by EDs and 45 healthy controls (HC) filled in the Attachment Style Questionnaire (ASQ), the Behavioral Inhibition System-Behavioral Activation System Scale (BIS-BAS) and the Eating Disorders Inventory-2 (EDI-2) questionnaire.

ED people reported significantly higher scores than HC in EDI-2 scores, all dimensions of insecure attachment style and sensitivity to punishment (BIS score). In ED patients, ASQ anxiety scores correlated with almost all EDI-2 subscores and sensitivity to punishment. The association between anxious attachment style and ED symptomatology (drive to thinness and body dissatisfaction) was totally mediated by an indirect effect of sensitivity to punishment.

These findings suggest, for the first time, increased sensitivity to punishment as a pathway that may explain the relationship between anxious attachment and ED symptomatology highlighting the relevance to target social experiences as an important psychotherapeutic focus.

Key Words: reward system; inhibition system; attachment style; emotional processing; anorexia nervosa; bulimia nervosa

1. Introduction

Eating disorders (EDs) are severe psychiatric syndromes characterized by a wide range of abnormal eating behaviors. Although the etiopathogenesis of these disorders still remains to be elucidated, recently, aberrant reward processes have been detected in people with EDs and it has been hypothesized that an altered balance of reward and inhibition motivation systems may contribute the disordered eating behaviors (Wierenga et al., 2014).

According to the Gray's theory of personality (1970), approach to reward stimuli and avoidance of aversive ones are regulated by two different systems: the Behavioral Activation System (BAS) reflecting reward sensitivity (Pickering and Smillie, 2008), and the Behavioral Inhibition System (BIS) related to punishment sensitivity (Corr et al., 1997). In a systematic review, Harrison et al. (2010) reported that while all ED people experience higher scores on sensitivity to punishment compared to healthy controls, subjects with Anorexia Nervosa Restrictive (ANR) subtype seem to score lower than those suffering from AN Binge-Purging subtype (ANBP) or Bulimia Nervosa (BN) in their sensitivity to reward. Moreover, a relation between these personality traits and ED psychopathology has been suggested in both people affected by AN (Jappe et al., 2011) and university female students (Loxton and Dawe 2001; Loxton and Dawe, 2006).

The dysregulation of motivational systems in ED people could be related to their difficulty in socio-emotional processing. According to the Ochsner's model (2008), the identification of social stimuli leading to aversive or rewarding outcomes is one of the main constructs of socio-emotional processing. In ED subjects, a heightened sensitivity in this field may be responsible of either their attentional bias towards emotional stimuli perceived as threatening or avoidance of them as shown by Oldershaw et al. (2011). Furthermore, Cardi and colleagues (2013) demonstrated that in ED people the increased vigilance to rejection and avoidance of social reward were predicted by the quality of parents' attachment relationships.

These last results point to a putative role of attachment style in motivated behaviors in the context of adult interpersonal relationships. According to the attachment theory, early interactions

with a caregiver affect emotion regulation in adult interpersonal situations (Hazan and Shaver 1987; Siegel, 1999). A continuity in the trajectory between attachment relationships and the motivation to form and maintain interpersonal relationships in the adulthood has been hypothesized (Baumeister and Leary, 1995). Hence, starting from earliest family interactions to adulthood affiliative interactions, attachment is involved in the regulation of the threat response enabling relationships as a source of safeness.

The relevance of disrupted attachment relationships in the development and maintenance of EDs has been proved by epidemiological and clinical studies (Caglar-Nazali et al., 2014; Dakanalis et al., 2014; Gander et al., 2015; Monteleone AM et al., 2017; O'Shaughnessy and Dallos, 2009). In healthy subjects, an association between insecure attachment and BIS (Ein-Dor et al., 2011) or BAS sensitivity (Meyer et al., 2005) or both (Jiang and Tiliopoulos, 2014) has been demonstrated. Recently, in a mixed sample of people affected by different EDs, the perceived low social rank and the rejection sensitivity have been found to mediate the relationship between insecure attachment style and disordered eating (De Paoli et al., 2017). To our knowledge, only one study investigated the relationship between attachment styles and reward and punishment sensitivity in subjects with AN and proved that the anxious attachment style predicts their punishment sensitivity (Keating et al., 2016); however, the relevance of such a relationship to ED psychopathology was not assessed. Therefore the relationships between attachment styles, ED symptomatology and sensitivity to reward and punishment in ED patients need to be investigated.

In the present study, we assessed whether alterations in motivated behaviors, conceptualized in terms of approach and inhibition systems, may be mediators between insecure attachment and ED symptomatology. In order to test this hypothesis, we evaluated attachment styles, ED symptomatology and sensitivity to reward and punishment in ED patients and matched healthy controls and explored possible relationships among these variables. The following hypotheses were tested: 1) insecure attachment levels are higher in ED people and are related to the ED severity; 2) the sensitivity to punishment and to reward is increased in EDs and is associated with ED

symptomatology; 3) insecure attachment levels predict sensitivity to punishment and to reward; 4) the behavioral motivation patterns mediate the relationship between insecure attachment style and ED symptomatology.

2. Methods

2.1 Subjects

Participants were recruited from subjects consecutively attending the outpatient Eating Disorder Unit of the Department of Psychiatry of the Naples' University of Campania "Luigi Vanvitelli" between December 1, 2015, and December 30, 2016 and meeting DSM-5 diagnostic criteria for current AN, atypical AN or BN. Exclusion criteria were: male gender, history of psychosis, psychoactive substance or drug use, presence of severe physical diseases, intellectual disability or current comorbid Axis I psychiatric disorders. Moreover, none of the patients reported a history of head trauma.

Female Healthy Controls (HC), with mean age and mean education levels not different from patients, were recruited among students of the Naples' University of Campania "Luigi Vanvitelli", provided they met the following inclusion criteria: absence of current and lifetime Axis I psychiatric disorders and intellectual disability, no history of substance abuse, absence of physical diseases and current drug use, body mass index (BMI) between 18.5 and 25.0 Kg/m².

2.2 Assessment

Sociodemographic, psychopathological and clinical data were collected through a face-to-face interview by expert psychiatrists. The diagnoses of AN and BN, the absence of concomitant Axis I mental disorders were ascertained by means of the Structured Clinical Interview for DSM 5 (First et al., 2015).

Each participant into the study was asked to fill in the following questionnaires: 1) the Italian version of Eating Disorders Inventory-2 (EDI-2) to assess eating attitudes and behaviors and related symptomatology; internal consistency reliability coefficients (Cronbach's alpha) for the EDI-2 subscales are between 0.44 and 0.93 (Garner, 1991); 2) the Trait scale of the State-Trait Anxiety Inventory (STAI) to evaluate trait feelings of anxiety; internal consistency reliability coefficients (Cronbach's alpha) for the STAI range from 0.86 to 0.95 (Spielberg et al., 1983); 3) the Italian version (Fossati et al., 2003) of Attachment Style Questionnaire (ASQ) to investigate the adult attachment style; 4) the Behavioral Inhibition System-Behavioral Activation System Scale (BIS-BAS, Carver and White, 1994) to assess sensitivity to punishment (BIS) and to reward (BAS).

The ASQ consists of 40 self-report items rated on a 6-point Likert-type format from 1 (totally disagree) to 6 (totally agree). Its scores are combined to provide 5 subscales: Confidence (C), Need for Approval (NA), Preoccupation with Relationships (PR), Discomfort with Closeness (DC) and Relationships as Secondary (RS). C subscale is an indicator of secure attachment style. Two composite scores, were calculated: the "anxiety" score, resulting from the combination of NA and PR subscale scores, and the "avoidance" score resulting from the combination of PR and RS scale scores. Cronbach's alpha coefficients for the five subscales (in the order described above) were 0.80, 0.84, 0.79, 0.76, and 0.76, respectively (Feeney et al., 1994).

The BIS-BAS scale consists of 20 self-rated items answered by means of a 4 point Likert scale ranging from 1 ("very true for me") to 4 ("very false for me"). Items are combined to compose one BIS scale, concerning reactions to negative events such as criticism, and three BAS scales, Drive, Fun Seeking and Reward Responsiveness, related to responses to reward stimuli. Internal consistency reliability coefficients for the four BIS/BAS scales (Cronbach's alpha) were between 0.65 and 0.83 (Jorm et al., 1999).

The study was approved by our Institutional Board. Participants signed a written informed consent after being fully informed about the nature and the procedures of the study.

2.3 Statistical analysis

One-way ANOVA followed by Tukey's post-hoc test was used to compare age, BMI, EDI-2, ASQ, BIS-BAS, STAI-T scores among the groups.

Pearson's correlations were performed to investigate the relationships among attachment style, behavioral inhibition and approach systems, ED-symptomatology and trait-anxiety in ED patients. Among EDI-2 subscores, we included in the analysis only the items drive to thinness, body dissatisfaction, ineffectiveness and social insecurity because the first two have been considered as the strongest markers of illness severity (Olatunji et al., 2012; Waldherr et al., 2008) and the latter two of high relevance to the ED psychopathology (Fairburn et al., 2003; Rieger et al., 2010). A regression model was calculated using the attachment anxiety score and the anxiety trait as predictors of BIS score in ED patients. Because of multiple tests, a level of significance at $p < 0.0005$ was set after applying the Bonferroni's correction for multiple tests; however, we maintained also those significances whose p was between < 0.05 and $= 0.0005$, according to explorative nature of our study (Bender and Lange, 2001).

Mediation analyses were conducted using the PROCESS macro for SPSS (Hayes, 2013) in the ED group. Analyses were conducted with attachment style as the predictor variable, the BIS subscale as the mediator and EDI-2 subitem scores as dependent variables. The statistical significances of mediating and indirect effects were assessed using bootstrapped bias-corrected percentile based confidence interval of 5000 bootstrap draws (Preacher and Hayes, 2008). All analyses were performed using SPSS version 23 (SPSS Inc, Chicago, IL).

3. Results

3.1 General results

The final sample consisted of 78 ED women and 45 HC. The ED sample was composed by 48 subjects with AN (mean \pm SD age = 25.15 ± 9 yrs) (38 with ANR and 10 with ANBP) and 30

subjects with BN (mean \pm SD age = 27.0 \pm 9.13yrs). Clinical and demographic characteristics of ED patients and HC are shown in Table 1.

As expected, AN and BN people scored higher than HC in EDI-2 scores, in all dimensions of insecure attachment style and in STAI-T questionnaire. No significant difference emerged between AN and BN patients in ASQ subscores, ASQ anxiety and avoidance composite scores, STAI-T and all EDI-2 subitem scores, with the exception of body dissatisfaction and bulimia scores that were significantly higher in the BN group. Compared to HC, AN and BN women reported significant higher scores on sensitivity to punishment (BIS score) but did not show any significant difference in Reward Responsiveness, Drive and Fun Seeking BAS scores. Compared to AN subjects, BN participants did not differ significantly in BIS, Reward Responsiveness and Drive BAS scores while they scored significantly higher on Fun Seeking BAS dimension ($p < 0.01$); when ANBP subjects were separated from the whole AN group, the difference in Fun Seeking BAS score remained statistically significant only between BN and ANR individuals ($p = 0.014$).

3.2 Regression and Pearson's correlations

Since AN and BN people did not differ in attachment, ED symptomatology, sensitivity to punishment and trait-anxiety scores and according to the transdiagnostic perspective of EDs (Fairburn et al., 2003), we combined AN and BN people in a whole ED group.

As shown in table 2, in ED patients ASQ C score negatively correlated with all EDI-2 subscores, STAI-T and BIS scores. The ASQ composite anxiety score, the PR and NA subscores positively correlated with STAI-T, BIS and some EDI-2 subitem scores (table 2). The ASQ DC and RS scores positively correlated with EDI-2 ineffectiveness and social insecurity and trait anxiety (table 2). No significant correlation emerged between ASQ composite anxiety and avoidance scores and sensitivity to reward (BAS scores). Moreover, BIS score correlated positively with all EDI-2 subscores and with trait anxiety (table 2).

The regression model showed that when the STAI trait and the ASQ anxiety score were entered as predictors and the BIS scale considered as the outcome variable, both anxiety trait ($B = 0.19$; $t = 0.42$; $p < 0.01$) and anxious attachment style ($B = 0.08$; $t = 2.33$; $p = 0.02$) independently predicted the behavioral inhibition in ED subjects.

3.3 Mediation model for the relationship between attachment style, sensitivity to reward/punishment and eating disorder symptomatology

Since BAS reactivity was not related to either attachment style or ED symptomatology, we tested whether the association between attachment style and ED symptomatology was explained by an indirect effect of sensitivity to punishment. In particular, this effect was demonstrated totally for the relationship between the ASQ composite anxiety score and EDI-2 drive to thinness dimension (Fig. 1) and for the connection between ASQ NA subscore and EDI-2 body dissatisfaction (Fig. 2). A partial mediation effect for the relationships between the ASQ composite anxiety score and EDI-2 ineffectiveness ($b = 0.06$; 95% C.I.: 0.01-0.15) and social insecurity ($b = 0.04$; 95% C.I.: 0.01-0.10) dimensions was also revealed. Indeed, the direct effect of the attachment score on the EDI-2 subscores persisted even though this relation was significantly mediated by BIS score.

As for the EDI-2 drive to thinness dimension, the preliminary conditions of Baron and Kenny's mediation theory (1986) were satisfied (Fig. 1): a) variation in levels of the independent variable (ASQ composite anxiety score) significantly accounted for variation of the mediator (BIS score); b) variation in the mediator significantly accounted for variation in the dependent variable (EDI-2 drive to thinness), and c) variation in the independent variable (ASQ composite anxiety score) significantly accounted for variation in the dependent variable (EDI-2 drive to thinness). Finally, when the first two conditions were controlled in a multivariate model, the previously significant relationship between ASQ composite anxiety score and EDI-2 drive to thinness score was no longer significant, and only the mediator (BIS score) retained its significance. Therefore, PROCESS estimated the total and the direct effect of the ASQ composite anxiety score on EDI-2

drive to thinness score, as well as the indirect effect through BIS score (mediator) (Baron and Kenny, 1986). Following recommendations by Edwards and Lambert (2007), we also used the bias-corrected bootstrapping method to construct the 95% CI for the indirect effect. The 95% CI for the indirect effect did not include zero. Therefore, we can conclude that the indirect effect was significantly different from zero at $\alpha = 0.05$, confirming the mediation role of the BIS score on the association between ASQ composite anxiety score and EDI-2 drive to thinness score. The same model was confirmed when ASQ C, NA and PR subscale scores were entered as independent variables.

4. Discussion

The aim of this study was to examine the relationships between attachment styles, ED symptomatology and sensitivity to reward and punishment in ED patients. Our first hypothesis was confirmed in that ED patients had higher levels of insecure attachment (both anxious and avoidant) with significant correlations between insecure attachment and ED symptomatology as assessed by the EDI-2 drive to thinness, body dissatisfaction, ineffectiveness and social insecurity dimensions. Second, in ED patients sensitivity to punishment was higher than in HC and predicted eating symptomatology whilst sensitivity to reward was slightly increased only in people affected by BN. Our third hypothesis was partially confirmed in that ED people with higher levels of anxious attachment style had higher sensitivity to punishment whereas no significant association emerged between insecure attachment dimensions and sensitivity to reward. Finally, we found that sensitivity to punishment mediated the relationship between insecure attachment style and ED symptomatology.

Present findings are in line with previous research studies showing a higher prevalence of insecure attachment style in ED patients compared to HC (Tasca and Balfour, 2014) and a connection between insecure attachment and the severity of ED symptoms (Abbate-Daga et al.,

2010; Amianto et al., 2011; Fassino et al., 2010; Keating et al., 2013; Troisi et al., 2006). Similarly, according to published literature studies (Beck et al., 2009; Claes et al., 2006; Harrison et al., 2011), we found an increased sensitivity to punishment in our AN and BN patients compared to HC, no significant difference in reward sensitivity between AN individuals and HC and an increased sensitivity to reward (BAS-Fun Seeking score) in BN participants compared to ANR ones, which could reflect the increased impulsivity associated with BN (Franken and Muris, 2006; Kane et al., 2004).

We also observed that the sensitivity to punishment was associated with the severity of ED symptoms (drive to thinness, body dissatisfaction, ineffectiveness and social insecurity). To the best of our knowledge, only one study previously identified this correlation in people with AN (Jappe et al., 2011). This finding is consistent with a large body of literature highlighting the importance of sensitivity to criticism and to social rejection and the poor quality of social relationships in the development and maintenance of EDs (Arceus et al., 2013; Caglar-Nazali et al., 2014; Cardi et al., 2014). Indeed, it has been hypothesized that the oversensitivity of motivational system, namely the sensitivity to punishment, may be compensated via perfectionism, harm avoidant behaviors and rigid cognitive styles that could reduce the negative feelings following the exposure to those social stimuli (Kaye et al., 2013).

In our study we demonstrated a relationship between insecure attachment style and increased sensitivity to punishment in ED patients. More in detail, the ASQ composite anxiety score and the ASQ NA and PR subscores correlated positively with BIS score while the ASQ C subscore correlated negatively with BIS score; instead, no significant correlation emerged between avoidant attachment style and BIS reactivity. Overall, these results suggest a possible specific link between anxious attachment and increased behavioral inhibition in ED patients. Consistent with our findings, Keating et al. (2016) found that anxious attachment style predicted sensitivity to punishment in people affected by AN contributing to their predisposition to negative social evaluation.

According to the rejection sensitivity model (Downey et al., 1997), early exposure to rejection, in conjunction with a biological vulnerability, leads individuals to emphasize the detection of threats of rejection (Dandeneau et al., 2007), through the activation of the defensive motivational system (Berenson et al., 2009). Insecure children become more focused on others as sources of threat and seem to be more likely prone to internalize a critical style (Gilbert and Irons, 2005; Mikulincer and Shaver, 2004, 2005). Therefore, we might suggest that attachment insecurity confers vulnerability to social stimuli information processing and ED people might be more prompt to inhibit their emotional and inner expression in the social scenario.

The lack of association between avoidant attachment dimension and BIS score that we found in our ED participants is in line with attachment theory. According to this, individuals with greater attachment avoidance are characterized by a dismissing view of the importance of the relationships: they avoid intimacy and tend to achieve self-reliance seeking interpersonal distance in situation of stress or threat (Fuendeling, 1998). For these reasons, they may be less incline to experience social criticism and inhibit their behaviors.

Finally, we showed that BIS scores mediated the association between anxious attachment style and ED symptoms. In particular, the relation between anxious attachment style and EDI-2 drive to thinness and body dissatisfaction in ED patients was completely mediated by the sensitivity to punishment (BIS score). Moreover, as far as EDI-2 ineffectiveness and social insecurity, these dimensions were explained by either a direct effect of the anxious attachment style and an indirect effect mediated by the BIS score. To our knowledge, this is the first study showing that the relationship between attachment style and ED symptomatology may be mediated by sensitivity to punishment. Our findings corroborated those from a recent study (De Paoli et al., 2017) in which appearance based rejection sensitivity was revealed to mediate the relationship between anxious attachment style and ED symptoms. We may interpret these data on the light of the “need to belong” theory (Adler, 1927; Baumeister and Leary, 1995) claiming that being accepted by others and feeling secure and safe in one’s social relationships is highly beneficial for well-being and

physical and mental health (Gilbert et al., 2008; MacDonald and Leary, 2005). Attachment (Bowlby, 1969) plays a significant part in this process as “our attachment relationships are the first place we learn about our attractiveness to others and the preparedness of others to invest resources in us” (Sloman et al., 2003). This procedure affects adult interpersonal relationships: insecure attached people not only tend to lack social support but also to perceive relationships as sources of stress (Mallinckrodt and Wei, 2005) becoming especially sensitive to social threat (Sloman and Atkinson, 2000). Threat requires a response: the concept of “fight of flight” is a well used evolutionary explanation and several different psychological problems have been suggested to be forms of fight or flight behaviours in response to the threat of exclusion (Gilbert, 2001, 2004). Therefore, our results confirm the suggestion that dietary restriction may be conceived as a “fight” behaviour in the attempt to become more attractive and powerful (Goss and Gilbert, 2002). Indeed, in many cultures food is abundantly available and resisting it has become a sign of the individual’s self-control ability, thus becoming social rewarding. In other words, the fear of negative evaluation may lead anxious attached people to inhibit their social expression and interactions and to restrict their eating in order to raise their status among peers. In line with this hypothesis, low social rank has been shown to mediate the association between childhood interpersonal adversity and ED symptoms severity (Connan et al., 2007; Matos et al., 2015).

Even if the cross-sectional design of our study does not allow us to draw causality conclusions, another possible explanation of the BIS sensitivity role may consist of heighten relational ambivalence for the anxious attached person in time of stress. Indeed, automatic attachment-related thoughts and action tendencies (i.e., proximity seeking) are triggered in situations of threat and, in the presence of a high sensitivity to punishment, are coupled with negative appraisals of the attachment figure’s availability. This is consistent with our findings showing a mediation role of “need for approval” subscale: this dimension well characterizes individuals as dependent although worried for others’ judgment. Therefore, we may suggest that

this relational ambivalence may be related to a deranged ability to cope with stress that plays a central role in ED psychopathology (Jacobi et al., 2004; Rojo et al., 2006).

The results of the present study should be considered in the light of some limitations. First, as mentioned above, the cross-sectional design of the study does not allow to establish a cause-consequence relationship between variables: for this reason, our results should be considered as preliminary and further studies with a longitudinal design are needed to clarify the causality in such relationships. Second, we used self-report questionnaire to measure attachment style: this kind of measures provide conscious attitudes toward relationships. Although there is large agreement in considering appropriate the use of dimensional self-report attachment instruments (Ravitz et al., 2010), an interview such as the Adult Attachment Interview, would be a more appropriate instrument. Furthermore, in the current sample, we did not measure the reliability of the adopted psychometric instruments, since they were widely validated questionnaires. Third, since ASQ and BIS/BAS scale could measure similar psychopathological dimensions, our data could describe a collinearity of redundant variables rather than a real mediation effect; however, by applying regression models where ASQ anxiety and BIS scores were included as independent variables and EDI-2 subscores as dependent ones, we found that the Variance Inflation Factor (VIF) value resulted 1.17, that is lower than the collinearity cut-off value of 10 (Myers, 1990). Fourth, we excluded patients with psychiatric comorbidity to avoid the interference of other psychiatric conditions on our results: this might reduce the generalizability of our findings, although anxiety symptoms were taken into consideration in our analysis.

The relevance of this study is that it provides support for the relationship between attachment styles and behavioral motivation patterns in women affected by EDs and suggests, for the first time, increased sensitivity to punishment as a pathway that may explain the relationship between anxious attachment and ED psychopathology. Therefore, this study contributes to better understanding how attachment experiences may affect motivated behaviors in ED patients. Moreover, our results

provide further corroboration to the ED model that claims social inhibition and lack of social support as main illness predisposing factors (Arceus et al., 2013).

Finally, our findings may have some clinical implications. Indeed, the increased behavioral inhibition of ED people has been implied in their difficulty to appropriately assess social stimuli in order to learn from them and this may interfere with their motivation to treatment (Wierenga et al., 2014). Moreover, on the light of the proved relationship between social experiences and motivational systems, it could be important addressing social acceptance and interpersonal difficulties as main targets of ED treatment. In particular, according to our study, the possibility to improve ED people ability to express their feelings and opinions in interpersonal contexts may be pursued in treatment processes to promote their resilience in social stress challenges. Overall, according to Bruch (1982), our findings suggest the importance of developing treatment interventions focusing on patients' attachment experiences that may allow ED people to understand how those events interfered with the development of their sensitivity to criticism and to mitigate it.

Declaration of interest:

The authors report no biomedical financial interests or potential conflicts of interest with this paper.

References

- Abbate-Daga, G., Gramaglia, C., Amianto, F., Marzola, E., Fassino, S., 2010. Attachment insecurity, personality, and body dissatisfaction in eating disorders. *J. Nerv. Ment. Dis.* 198, 520-524. <http://doi:10.1097/nmd.0b013e3181e4c6f7>
- Adler, A., 1927. Individual psychology. *J. Abnorm. Psychol.* 22, 116-122. <http://dx.doi.org/10.1037/h0072190>
- Amianto, F., Abbate-Daga, G., Morando, S., Sobrero, C., Fassino, S., 2011. Personality development characteristics of women with anorexia nervosa, their healthy siblings and healthy

controls: What prevents and what relates to psychopathology?. *Psychiatry Res.* 187, 401-408.

<http://doi:10.1016/j.psychres.2010.10.028>

Arceus, J., Haslam, M., Farrow, C., Meyer, C., 2013. The role of interpersonal functioning in the maintenance of eating psychopathology: a systematic review and testable model. *Clin. Psychol. Rev.* 33, 156-167. <http://doi:10.1016/j.cpr.2012.10.009>

Baron, R.M., Kenny, D.A., 1986. The moderator-mediator variable distinction in social

psychological research: conceptual, strategic, and statistical considerations. *J. Pers. Soc. Psychol.* 51, 1173–1182. <http://doi:10.1037/0022-3514.51.6.1173>

Baumeister, R.F., Leary, M.R., 1995. The need to belong: desire for interpersonal attachments as a

fundamental human motivation. *Psychol. Bull.* 117, 497-529. <http://dx.doi.org/10.1037/0033-2909.117.3.497>

Beck, I., Smits, D.J.M., Claes, L., Vandereycken, W., Bijttebiera, P., 2009. Psychometric evaluation of the behavioral inhibition/behavioral activation system scales and the sensitivity to punishment and sensitivity to reward questionnaire in a sample of eating disordered patients. *Pers. Individ. Differ.* 47, 407-412. <https://doi.org/10.1016/j.paid.2009.04.007>

Bender, R., Lange, S., 2001. Adjusting for multiple testing—when and how?. *J. Clin. Epidemiol.* 54, 343-349. [https://doi.org/10.1016/S0895-4356\(00\)00314-0](https://doi.org/10.1016/S0895-4356(00)00314-0)

Berenson, K.R., Gyurak, A., Ayduk, O., Downey, G., Garner, M.J., Mogg, K., et al. 2009. Rejection

sensitivity and disruption of attention by social threat cues. *J. Res. Pers.* 43, 1064-1072. <http://doi:10.1016/j.jrp.2009.07.007>

Bowlby, J., 1969. *Attachment and Loss*, second ed. Basic Books, New York.

Bruch, H., 1982. Anorexia nervosa: Therapy and theory. *Am. J. Psychiat.* 139, 1531-1538.

<https://doi.org/10.1176/ajp.139.12.1531>

Caglar-Nazali, H.P., Corfield, F., Cardi, V., Ambwani, S., Leppanen, J., Olabintan, O., et al. 2014.

A systematic review and meta-analysis of ‘Systems for Social Processes’ in eating disorders.

Neurosci. Biobehav. Rev. 42, 55-92. <http://doi:10.1016/j.neubiorev.2013.12.002>

- Cardi, V., Di Matteo, R., Corfield, F., Treasure, J., 2013. Social reward and rejection sensitivity in eating disorders: An investigation of attentional bias and early experiences. *World J. Biol. Psychiatry*. 14, 622-633. <http://doi:10.3109/15622975.2012.665479>
- Cardi, V., Di Matteo, R., Gilbert, P., Treasure, J., 2014. Rank perception and self-evaluation in eating disorders. *Int. J. Eat. Disord.* 47, 543-552. <http://doi:10.1002/eat.22261>
- Carver, C.S., White, T.L., 1994. Behavioral inhibition, behavioral activation, and affective responses to impending reward and punishment: The BIS/BAS Scales. *J. Pers. Soc. Psychol.* 67, 319–333. <http://doi:10.1037/0022-3514.67.2.319>
- Claes, L., Nederkoorn, C., Vandereycken, W., Guerrieri, R., Vertommen, H., 2006. Impulsiveness and lack of inhibitory control in eating disorders. *Eat. Behav.* 7, 196-203. <http://doi:10.1016/j.eatbeh.2006.05.001>
- Connan, F., Troop, N., Landau, S., Campbell, I.C., Treasure, J., 2007. Poor social comparison and the tendency to submissive behavior in anorexia nervosa. *Int. J. Eat. Disord.* 40, 733-739. <http://doi:10.1002/eat.20427>
- Corr, P.J., Pickering, A.D., Gray, J.A., 1997. Personality, punishment, and procedural learning: A test of J.A. Gray's anxiety theory. *J. Pers. Soc. Psychol.* 73, 337–344. <http://doi:10.1016/j.biopsycho.2011.05.028>
- Dakanalis, A., Timko, C. A., Zanetti, M. A., Rinaldi, L., Prunas, A., Carrà, G., et al. 2014. Attachment insecurities, maladaptive perfectionism, and eating disorder symptoms: A latent mediated and moderated structural equation modeling analysis across diagnostic groups. *Psychiatry Res.* 215, 176-184. <https://doi.org/10.1016/j.psychres.2013.10.039>
- Dandeneau, S.D., Baldwin, M.W., Baccus, J.R., Sakellaropoulou, M., Pruessner, J.C., 2007. Cutting stress off at the pass: reducing vigilance and responsiveness to social threat by manipulating attention. *J. Pers. Soc. Psychol.* 93, 651-666. <http://doi:10.1037/0022-3514.93.4.651>

- De Paoli, T., Fuller- Tyszkiewicz, M., Halliwell, E., Puccio, F., Krug, I., 2017. Social Rank and Rejection Sensitivity as Mediators of the Relationship between Insecure Attachment and Disordered Eating. *Eur. Eat. Disord. Rev.* 25 (6), 469-478. <http://dx.doi.org/10.1002/erv.2537>
- Downey, G., Khouri, H., Feldman, S., 1997. Early interpersonal trauma and adult adjustment: the mediational role of rejection sensitivity, in: Cicchetti, D., Toth, S., (Eds.), *Rochester Symposium on Developmental Psychopathology, Volume VIII: The Effects of Trauma on the Developmental Process*. University of Rochester Press, Rochester, NY, pp. 85–114.
- Edwards, J.R., Lambert, L.S., 2007. Methods for integrating moderation and mediation: a general analytical framework using moderated path analysis. *Psychol. Methods.* 12, 1-22.
<http://doi:10.1037/1082-989X.12.1.1>
- Ein-Dor, T., Mikulincer, M., Shaver, P.R., 2011. Attachment insecurities and the processing of threat-related information: Studying the schemas involved in insecure people's coping strategies. *J. Pers. Soc. Psychol.* 101, 78-93. <http://doi:10.1037/a0022503>
- Fairburn, C.G., Cooper, Z., Shafran, R., 2003. Cognitive behaviour therapy for eating disorders: a "transdiagnostic" theory and treatment. *Behav. Res. Ther.* 41, 509-528.
<http://doi:10.1176/appi.ajp.2008.08040608>
- Fassino, S., Amianto, F., Rocca, G., Abbate-Daga, G., 2010. Parental bonding and eating psychopathology in bulimia nervosa: personality traits as possible mediators. *Epidemiol. Psichiatr. Soc.* 19, 214-222. <http://doi:10.1017/S1121189X00001147>
- Feeney, J.A., Noller, P., Hanrahan, M., 1994. Assessing adult attachment, in: Sperling, M.B., Berman, W.H. (Eds.), *Attachment in Adults: Clinical and Developmental Perspectives*. Guilford Press, New York, pp. 128–152.
- First, M.B., Williams, J.B.W., Karg, R.S., Spitzer, R.L., 2015. User's Guide for the Structured Clinical Interview for DSM-5 Disorders, Research Version (SCID-5-RV). American Psychiatric Association, Arlington.

- Fossati, A., Feeney, J.A., Donati, D., Donini, M., Novella, L., Bagnato, M., et al. 2003. On the dimensionality of the attachment style questionnaire in Italian clinical and nonclinical participants. *J. Soc. Pers. Relat.* 20, 55–79. <http://doi: 10.1177/02654075030201003>
- Franken, I.H.A., Muris, P., 2006. Gray's impulsivity dimension: A distinction between reward sensitivity versus rash impulsiveness. *Pers. Individ. Differ.* 40, 1337-1347.
<https://doi.org/10.1016/j.paid.2005.11.016>
- Fuendeling, J.M., 1998. Affect regulation as a stylistic process within adult attachment. *J. Soc. Pers. Relat.* 15, 291-322. <http://dx.doi.org/10.1177/0265407598153001>
- Gander, M., Sevecke, K., Buchheim, A., 2015. Eating disorders in adolescence: attachment issues from a developmental perspective. *Front. Psychol.* 6, 1136. <http://doi.10.3389/fpsyg.2015.01136>
- Garner, D.M., 1991. Eating Disorder Inventory-2. Professional Manual. Psychological Assessment Research. Odessa. <http://doi.10.1177/1073191111428761>.
- Gilbert, P., 2001. Evolution and social anxiety. The role of attraction, social competition, and social hierarchies. *Psychiat. Clin. N. Am.* 24, 723-751. [http://dx.doi.org/10.1016/S0193-953X\(05\)70260-4](http://dx.doi.org/10.1016/S0193-953X(05)70260-4)
- Gilbert, P., 2004. *Evolutionary Theory and Cognitive Therapy*. Springer Ed., New York.
- Gilbert, P., Irons, C., 2005. A pilot exploration of the use of compassionate images in a group of self-critical people. *Memory.* 12, 507-516. <http://doi:10.1080/09658210444000115>
- Gilbert, K., McEwan, K., Mitra, R., Franks, L., Richter, A., Rockliff, H., 2008. Feeling safe and content: A specific affect regulation system? Relationship to depression, anxiety, stress, and self-criticism. *J. Posit. Psychol.* 3, 182-191. <http://dx.doi.org/10.1080/17439760801999461>
- Goss, K.P., Gilbert, P., 2002. Eating disorders, shame and pride: a cognitive-behavioural functional analysis, in: Gilbert, P., Miles, J. (Eds.), *Body Shame: Conceptualization, Research & Treatment*. Brunner-Routledge, Hove, UK, pp. 219-255.

- Gray, J.A., 1970. The psychophysiological basis of introversion-extraversion. *Behav. Res. Ther.* 8, 249-266. [https://doi.org/10.1016/0005-7967\(70\)90069-0](https://doi.org/10.1016/0005-7967(70)90069-0)
- Hayes, A.F., Preacher, K.J., 2014. Statistical mediation analysis with a multicategorical independent variable. *Brit. J. Math. Stat. Psy.* 67, 451–470. <http://doi:10.1111/bmsp.12028>
- Harrison, A., O'Brien, N., Lopez, C., Treasure, J., 2010. Sensitivity to reward and punishment in eating disorders. *Psychiatry Res.* 177, 1-11. <http://doi:10.1016/j.psychres.2009.06.010>.
- Harrison, A., Treasure, J., Smillie, L.D., 2011. Approach and avoidance motivation in eating disorders. *Psychiatry Res.* 188, 396-401. <http://doi:10.1016/j.psychres.2011.04.022>
- Hazan, C., Shaver, P., 1987. Romantic love conceptualized as an attachment process. *J. Pers. Soc. Psychol.* 52, 511-524. <http://dx.doi.org/10.1037/0022-3514.52.3.511>
- Jacobi, C., Hayward, C., de Zwaan, M., Kraemer, H.C., Agras, W.S., 2004. Coming to terms with risk factors for eating disorders: application of risk terminology and suggestions for a general taxonomy. *Psychol. Bull.* 130, 19-65. <http://doi:10.1037/0033-2909.130.1.19>
- Jappe, L.M., Frank, G.K., Shott, M.E., Rollin, M.D., Pryor, T., Hagman, J.O., et al. 2011. Heightened sensitivity to reward and punishment in anorexia nervosa. *Int. J. Eat. Disord.* 44, 317-324. <http://doi:10.1002/eat.20815>
- Jiang, Y., Tiliopoulos, N., 2014. Individual differences in adult attachment and reinforcement sensitivity. *Pers. Individ. Differ.* 68, 205-210. <https://doi.org/10.1016/j.paid.2014.04.022>
- Jorm, A. F., Christensen, H., Henderson, A. S., Jacomb, P. A., Korten, A. E., Rodgers, B., 1998. Using the BIS/BAS scales to measure behavioural inhibition and behavioural activation: Factor structure, validity and norms in a large community sample. *Pers. Individ. Differ.* 26, 49-58. [https://doi.org/10.1016/S0191-8869\(98\)00143-3](https://doi.org/10.1016/S0191-8869(98)00143-3)
- Kane, T.A., Loxtonb, N.J., Staigera, P.K., Daweb, S., 2004. Does the tendency to act impulsively underlie binge eating and alcohol use problems? An empirical investigation. *Pers. Individ. Differ.* 36, 83-94. [http://doi.org/10.1016/S0191-8869\(03\)00070-9](http://doi.org/10.1016/S0191-8869(03)00070-9)

- Kaye, W.H., Wierenga, C.E., Bailer, U.F., Simmons, A.N., Bischoff-Grethe, A., 2013. Nothing tastes as good as skinny feels: the neurobiology of anorexia nervosa. *Trends. Neurosci.* 36, 110-120.
<http://doi:10.1016/j.tins.2013.01.003>
- Keating, C., Castle, D.J., Newton, R., Huang, C., Rossell, S.L., 2016. Attachment insecurity predicts punishment sensitivity in anorexia nervosa. *J. Nerv. Ment. Dis.* 204, 793-798.
<http://doi:10.1097/NMD.0000000000000569>
- Keating, L., Tasca, G.A., Hill, R., 2013. Structural relationships among attachment insecurity, alexithymia, and body esteem in women with eating disorders. *Eat. Behav.* 14, 366-373.
<http://doi:10.1016/j.eatbeh.2013.06.013>
- Loxton, N.J., Dawe, S., 2001. Alcohol abuse and dysfunctional eating in adolescent girls: the influence of individual differences in sensitivity to reward and punishment. *Int. J. Eat. Disord.* 29, 455-462. <http://doi:10.1002/eat.1042>
- Loxton, N.J., Dawe, S., 2006. Reward and punishment sensitivity in dysfunctional eating and hazardous drinking women: Associations with family risk. *Appetite.* 47, 361-371.
<http://doi:10.1016/j.appet.2006.05.014>
- Macdonald, G., Leary, M.R., 2005. Why does social exclusion hurt? The relationship between social and physical pain. *Psychol. Bull.* 131, 202-223. <http://doi:10.1037/0033-2909.131.2.202>
- Mallinckrodt, B., Wei, M., 2005. Attachment, social competencies, social support, and psychological distress. *J. Couns. Psychol.* 52, 358-367. <http://doi:10.1037/0022-0167.52.3.358>
- Matos, M., Ferreira, C., Duarte, C., Pinto-Gouveia, J., 2015. Eating disorders: when social rank perceptions are shaped by early shame experiences. *Psychol. Psychoter.* 88, 38-53.
<http://doi:10.1111/papt.12027>
- Meyer, B., Olivier, L., Roth, D.A., 2005. Please don't leave me! BIS/BAS, attachment styles, and responses to a relationship threat. *Pers. Individ. Diff.* 38, 151-162.
<http://doi.org/10.1016/j.paid.2004.03.016>

- Mikulincer, M., Shaver, P.R., Gillath, O., Nitzberg, R.A., 2005. Attachment, caregiving, and altruism: boosting attachment security increases compassion and helping. *J. Pers. Soc. Psychol.* 89, 817-839. <http://doi:10.1037/0022-3514.89.5.817>
- Myers, R., 1990. *Classical and Modern Regression With Applications* (2nd ed.). Duxbury, Boston, MA.
- Monteleone, A. M., Castellini, G., Ricca, V., Volpe, U., De Riso, F., Nigro, M., et al. 2017. Embodiment mediates the relationship between avoidant attachment and eating disorder psychopathology. *Eur. Eat. Disord. Rev.* 25(6), 461-468. <http://doi:10.1002/erv.2536>
- Ochsner, K.N., 2008. The social-emotional processing stream: five core constructs and their translational potential for schizophrenia and beyond. *Biol. Psychiatry.* 64, 48-61. <http://doi:10.1016/j.biopsych.2008.04.024>
- Olatunji, B. O., Broman-Fulks, J. J., Ciesielski, B. G., Zawilinski, L. L., Shewmaker, S., Wall, D., 2012. A taxometric investigation of the latent structure of eating disorders. *Psychiatry Res.* 197, 97-102. <https://doi.org/10.1016/j.psychres.2011.12.016>
- Oldershaw, A., Hambrook, D., Stahl, D., Tchanturia, K., Treasure, J., Schmidt, U., 2011. The socio-emotional processing stream in anorexia nervosa. *Neurosci. Biobehav. Rev.* 35, 970-988. <http://doi:10.1016/j.neubiorev.2010.11.001>
- O'Shaughnessy, R., Dallos, R., 2009. Attachment research and eating disorders: A review of the literature. *Clin. Child. Psychol. Psychiatry.* 14, 559-574. <http://doi:10.1177/1359104509339082>
- Pickering, A.D., Smillie, L.D., 2008. The behavioural activation system: Challenges and opportunities, in: Corr, P.J. Ed., *The Reinforcement Sensitivity Theory of Personality*. Cambridge University Press, Cambridge, pp. 120-154. <https://doi.org/10.1017/CBO9780511819384.005>
- Preacher, K.J., Hayes, A.F., 2008. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behav. Res. Methods.* 40, 879-891. <http://doi:10.3758/BRM.40.3.879>

- Ravitz, P., Maunder, R., Hunter, J., Sthankiya, B., Lancee, W., 2010. Adult attachment measures: A 25-year review. *J. Psychosom. Res.* 69, 419-432. <http://doi:10.1016/j.jpsychores.2009.08.006>
- Rieger, E., Van Buren, D. J., Bishop, M., Tanofsky-Kraff, M., Welch, R., Wilfley, D. E., 2010. An eating disorder-specific model of interpersonal psychotherapy (IPT-ED): Causal pathways and treatment implications. *Clin. Psychol. Rev.* 30, 400-410. <https://doi.org/10.1016/j.cpr.2010.02.001>
- Rojo, L., Conesa, L., Bermudez, O., Livianos, L., 2006. Influence of stress in the onset of eating disorders: Data from a two-stage epidemiologic controlled study. *Psychosom. Med.* 68, 628–635. <http://doi:10.1097/01.psy.0000227749.58726.41>
- Shaver, P.R., Mikulincer, M., 2004. Attachment in the later years: a commentary. *Attach. Hum. Dev.* 6, 451-464. <http://doi:10.1080/1461673042000303082>
- Siegel, D.J., 1999. *The Developing Mind: Toward a Neurobiology of Interpersonal Experience*. Guilford Press, New York.
- Sloman, L., Atkinson, L., 2000. Social competition and attachment, in: Sloman, L., Gilbert, P., (Eds.), *Subordination and Defeat: An Evolutionary Approach to Mood Disorders and their Therapy*. Lawrence Erlbaum Associates, Mahwah, NJ, pp. 199-214.
- Sloman, L., Gilbert, P., Hasey, G., 2003. Evolved mechanisms in depression: the role and interaction of attachment and social rank in depression. *J. Affect. Disord.* 74, 107-121. [http://doi:10.1016/S0165-0327\(02\)00116-7](http://doi:10.1016/S0165-0327(02)00116-7)
- Spielberger, C.D., Gorsuch, R., Lushene, R., Vagg, P.R., Jacobs, G.A., 1983. *Manual for the State-Trait Anxiety Inventory (Form Y)*. Consulting Psychologists Press, Palo Alto, CA.
- Tasca, G.A., Balfour, L., 2014. Attachment and eating disorders: A review of current research. *Int. J. Eat. Disord.* 47, 710-717. <http://doi:10.1002/eat.22302>.

Troisi, A., Di Lorenzo, G., Alcini, S., Nanni, R.C., Di Pasquale, C., Siracusano, A., 2006. Body dissatisfaction in women with eating disorders: Relationship to early separation anxiety and insecure attachment. *Psychosom. Med.* 68, 449-453.

<http://doi:10.1097/01.psy.0000204923.09390.5b>

Waldherr, K., Favaro, A., Santonastaso, P., Van Strien, T., Rathner, G., 2008. Comparison of the eating disorder inventory (EDI) in the Netherlands, Austria and Italy. *Eur. Eat. Disord. Rev.* 16, 472-479. <http://doi: 10.1002/erv.881>

Wierenga, C.E., Ely, A., Bischoff-Grethe, A., Bailer, U.F., Simmons, A.N., Kaye, W.H., 2014. Are extremes of consumption in eating disorders related to an altered balance between reward and inhibition? *Front. Behav. Neurosci.* 8, 410. <http://doi: 10.3389/fnbeh.2014.00410>

Legends to Figures

Fig. 1 Total, direct and indirect effect (through the mediation of BIS score) of the ASQ composite anxiety score on drive to thinness in patients with eating disorders.

* $p < 0.05$ ** $p < 0.001$

Abbreviations: EDI-2: Eating Disorder Inventory-2; BIS: Behavioral Inhibition System; ASQ: Attachment Style Questionnaire

Fig. 2 Total, direct and indirect effect (through the mediation of BIS score) of the ASQ NA subscore on body dissatisfaction in ED patients with eating disorders.

* $p < 0.05$ ** $p < 0.001$

Abbreviations: EDI-2: Eating Disorder Inventory-2; BIS: Behavioral Inhibition System; ASQ NA:

Attachment Style Questionnaire Need for Approval subscore

Table 1 Clinical and demographic characteristics of ED patients and healthy subjects. Data are expressed as mean \pm SD.

	Healthy Subjects (<i>n</i> =45)	Subjects with Anorexia Nervosa (<i>n</i> =48)	Subjects with Bulimia nervosa (<i>n</i> =30)	<i>F</i>	<i>P</i>
AGE, yrs	26.25 \pm 1.95	25.31 \pm 9.00	27.00 \pm 9.14	0.494	0.611
BMI, kg/m ²	21.16 \pm 1.75	17.29 \pm 2.08**	23.12 \pm 7.04#	22.550	<0.0001
EDI-2_IN	1.76 \pm 2.47	11.88 \pm 8.65**	14.37 \pm 8.63**	36.528	<0.0001
EDI-2_MF	4.76 \pm 4.14	11.1 \pm 6.98**	8.93 \pm 5.77**	14.273	<0.0001
EDI-2_SI	3.20 \pm 2.83	8.69 \pm 5.08**	8.57 \pm 4.76**	22.790	<0.0001
EDI-2_BD	5.98 \pm 4.29	12.94 \pm 7.48**	16.87 \pm 7.67**#	27.181	<0.0001
EDI-2_P	3.64 \pm 3.29	7.56 \pm 4.43**	6.60 \pm 4.89**	10.796	<0.0001
EDI-2_ID	2.47 \pm 2.68	7.92 \pm 4.86**	6.93 \pm 4.89**	21.253	<0.0001
EDI-2_I	1.84 \pm 3.53	8.71 \pm 7.45**	10.9 \pm 7.9**	21.556	<0.0001
EDI-2_DT	1.91 \pm 3.47	13.4 \pm 7.33**	15.9 \pm 6.33**	64.547	<0.0001
EDI-2_BU	0.71 \pm 1.16	3.44 \pm 5.04**	10.23 \pm 6.2**#	42.144	<0.0001
EDI-2_IA	0.73 \pm 1.54	13.58 \pm 8.45**	16.37 \pm 7.74**	65.514	<0.0001
EDI-2_ASC	2.53 \pm 1.71	7.85 \pm 5.89**	9.03 \pm 4.25**	27.654	<0.0001
STAI_T	39.19 \pm 6.83	57.36 \pm 9.87**	59.79 \pm 9.62**	63.775	<0.0001
ASQ_C	32.76 \pm 4.83	25.48 \pm 7.81**	24.3 \pm 6.84**	19.771	<0.0001
ASQ_DC	36.71 \pm 7.08	41.5 \pm 8.14*	41 \pm 5.87*	5.767	0.004
ASQ_RS	13.6 \pm 4.83	19.5 \pm 6.5**	19.2 \pm 5.05**	15.282	<0.0001
ASQ_NA	18.96 \pm 5.04	28.23 \pm 7.85**	28.1 \pm 7.55**	25.700	<0.0001
ASQ_PR	26.42 \pm 5.49	34.02 \pm 7.26**	35.00 \pm 7.92**	19.532	<0.0001
BIS	24.45 \pm 3.72	29.00 \pm 4.49**	27.97 \pm 4.63**	13.776	<0.0001
BISBAS_RR	19.07 \pm 3.47	19.51 \pm 3.93	20.07 \pm 3.63	0.653	0.522
BISBAS_D	11.82 \pm 2.82	12.72 \pm 4.09	12.13 \pm 3.42	0.778	0.462
BISBAS_FS	10.27 \pm 2.54	9.55 \pm 3.57	12.03 \pm 3.4*#	5.625	0.005
ONSET AGE	-	17.23 \pm 0.77	19.79 \pm 1.45		

DURATION - 7.84 ± 1.21 7.86 ± 1.36

* $p < 0.05$ and ** $p < 0.01$ vs healthy subjects (post hoc Tukey's test); # $p < 0.05$ vs subjects with anorexia nervosa (post hoc Tukey's test). Bolded asterisks and hashtags indicate those comparisons that remained statistically significant after applying the Bonferroni's correction for multiple tests ($p < 0.0005$).

Abbreviations: EDI-2: Eating Disorder Inventory-2, IN: Ineffectiveness, MF: Maturity Fears, SI: Social Insecurity, BD: Body Dissatisfaction, P: Perfectionism, ID: Interpersonal Distrust, I: Impulse, DT: Drive for Thinness, BU: Bulimia, IA: Interoceptive Awareness, ASC: Ascetism; STAI-T: State-Trait Anxiety Inventory-Trait; ASQ: Attachment Style Questionnaire, C: Confidence, DC: Discomfort with Closeness, RS: Relationships as Secondary, NA: Need for Approval, PR: Preoccupation with Relationships; BIS/BAS: Behavioral Inhibition/Behavioral Activation Scale, RR: Reward Responsiveness, D: Drive, FS: Fun Seeking.

Table 2 Pearson's correlation coefficients in the patient group. Bolded values indicate those correlations that remained statistically significant after applying the Bonferroni's correction for multiple tests ($p < 0.0005$)

	BIS	BAS_ RR	BAS_ D	BAS_ FS	EDI- 2_IN	EDI- 2_SI	EDI- 2_BD	EDI- 2_DT	STAI_ T
ASQ_C	- 0.410 **	0.039	0.120	-0.012	- 0.643 **	- 0.584 **	- 0.378 **	- 0.316 **	- 0.423 *
ASQ_DC	0.023	-0.077	- 0.018	-0.167	0.249 *	0.333 **	0.120	0.203	0.246*
ASQ_RS	0.096	0.202	0.258 *	-0.014	0.299 **	0.311 **	0.203	0.138	0.176
ASQ_NA	0.415 **	0.133	0.034	-0.144	0.547 **	0.454 **	0.222 *	0.269 *	0.393 *
ASQ_PR	0.306 **	0.186	0.145	0.029	0.428 **	0.286 *	0.152	0.246 *	0.297 *
ASQ_Anxiety	0.386 **	0.171	0.095	-0.063	0.522 **	0.397 **	0.200	0.276 *	0.371 *
ASQ_Avoidance	0.068	0.059	0.129	-0.120	0.332 **	0.395 **	0.192	0.212	0.262*
BIS					0.406 **	0.450 **	0.337 **	0.425 **	0.511 *
BAS_RR					- 0.097	- 0.021	- 0.082	- 0.089	-0.067
BAS_D					- 0.118	0.003	- 0.061	0.044	0.065
BAS_FS					-	-	-	0.159	-0.033

0.140 0.238 0.028
*

STAI_T

0.654 **0.601** **0.520** **0.552**
** **

**Correlation is significant at $p < 0.01$ level (2-tailed). *Correlation is significant at $p < 0.05$ level (2-tailed).

Abbreviations: EDI-2: Eating Disorder Inventory-2, IN: Ineffectiveness, -SI: Social Insecurity, BD: Body Dissatisfaction, DT: Drive for Thinness; STAI-T: State-Trait Anxiety Inventory; ASQ: Attachment Style Questionnaire, C: Confidence, DC: Discomfort with Closeness, RS: Relationships as Secondary, NA: Need for Approval, PR: Preoccupation with Relationships; BIS/BAS: Behavioral Inhibition/Behavioral Activation Scale, RR: Reward Responsiveness, D: Drive, FS: Fun Seeking. ECR: Experiences in Close Relationships Scale.

Figure 1

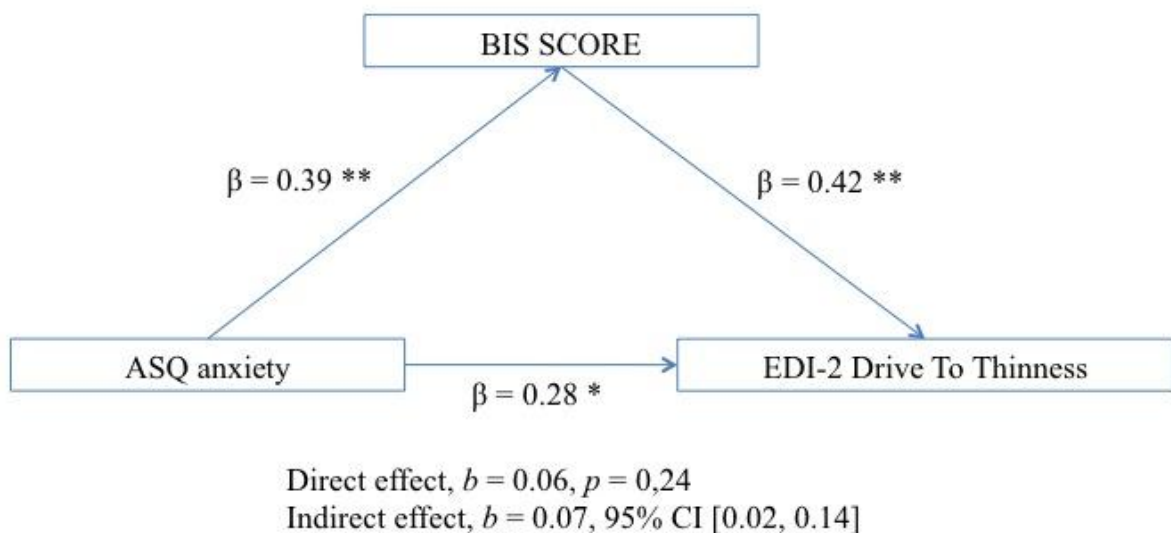
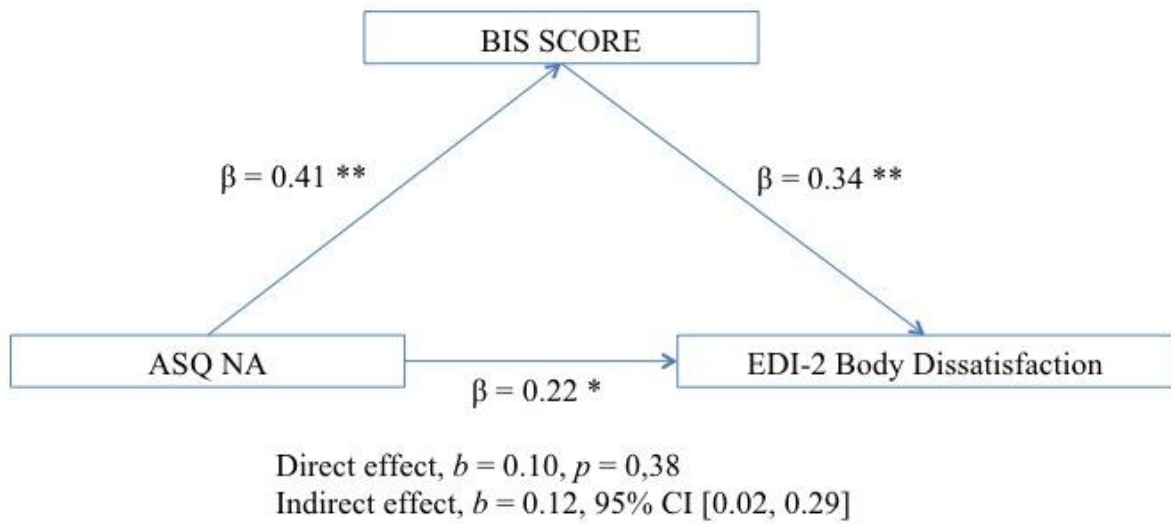


Figure 2



Highlights

- ED people showed high levels of insecure attachment and punishment sensitivity
- Insecure attachment and sensitivity to punishment correlated with ED symptomatology
- Sensitivity to punishment mediated the effects of anxious attachment on ED psychopathology
- Social experiences are an important focus in psychotherapeutic interventions